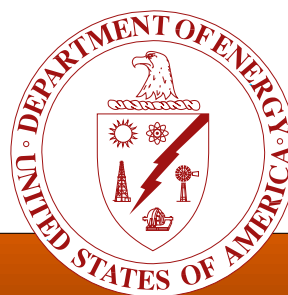


Followup Review of Accident Investigations at The Los Alamos National Laboratory

January 1998



Office of Environment, Safety and Health

1.0

Introduction

In addition to evaluating safety and security management, the mission of the Department of Energy (DOE) Office of Oversight includes a commitment to verify that issues or concerns identified during evaluations and accident investigations are brought to a satisfactory resolution. Specifically, the accident investigation program defined in DOE Order 225.1A requires the Assistant Secretary for Environment, Safety, and Health (ES&H), through the Office of the Deputy Assistant Secretary for Oversight, to verify completion of approved corrective actions and satisfaction of judgments of need (JONs) identified in Type A and Type B accident investigations. To meet this requirement, the Office of Oversight evaluates corrective action implementation plans, the timeliness of related schedules, progress made toward accomplishing corrective action plans, and the effectiveness of those corrective actions.

This followup effort was conducted January 5-16, 1998. The followup team consisted of Office of Oversight personnel who had relevant experience and prior knowledge of Los Alamos National Laboratory (LANL) operations. The timing of this followup effort allowed LANL sufficient time for corrective actions to be designed and initiated, and for improvements to become visible.

2.0

Background

The scope of this followup review at LANL included corrective actions addressing the JONs from three Type A accident investigations (see text box on page 2 for a summary of these three accidents). The JONs encompassed a broad range of issues that were grouped into the following four areas for the purpose of this Oversight followup review:

- Management systems and worker empowerment
- Work planning and control
- Electrical safety
- Corrective action, assessments, lessons learned, and training.

Corrective action plans to address the JONs for each accident were developed by the Albuquerque Operations Office (AL), the Los Alamos Area Office (LAAO), and LANL. The corrective action plans were submitted to AL for approval and the Office of Environment, Safety, and Health for concurrence and comment.

The Oversight review team examined the relevant JONs that were the responsibility of the AL, LAAO, and LANL to correct. Within the LANL organization, the Facility Management Unit organizations that have current responsibility for the buildings where the accidents occurred are:

- Facility Management Unit 77, the Physics Division (commonly referred to as P-Division), which manages Building 128 in Technical Area 35, where the forklift accident occurred
- Facility Management Unit 70, the Engineering Sciences and Applications Division, which manages Building 209 in Technical Area 21, where the jackhammer accident occurred, and Johnson Controls North New Mexico (JCNNM), which is the LANL subcontractor that performs maintenance, construction, and other such activities at the LANL site

- Facility Management Unit 61, the Los Alamos Neutron Science Center (commonly referred to as LANSCE), which manages Building MPF-14 in Technical Area 53, where the microwave accident occurred.

Subsequent to the three accidents, LANL, in conjunction with AL and LAAO, began to implement the DOE integrated safety management (ISM) program as required by DOE Order 450.4, Safety Management System. Properly implemented, the ISM program is a comprehensive approach to integrating safety into all aspects of site operations. LANL is making ISM the cornerstone of its Environment, Safety, and Health

program, and DOE and LANL have incorporated ISM as a major element of the LANL management contract. As such, the ISM program encompasses many of the corrective actions that were developed to address systematic weaknesses identified in the accident investigation reports, such as deficiencies in site-wide policies and procedures. ISM also encompasses key elements of the site management systems that are an integral part of ES&H programs and accident prevention, such as roles and responsibilities, standards and requirements, and assessments. Because of the interrelationship between the JON corrective actions and ISM, the Oversight team reviewed LANL use of the ISM framework for completing JON corrective actions.

Summary of Three “Type A” Accidents at LANL

Forklift Accident – November 22, 1995: A LANL technical staff member was positioning a forklift on a sidewalk outside Building 128 at Technical Area 35 when the left rear wheel slipped over the edge of the sidewalk, toppling the forklift on its side and pinning the staff member’s neck and foot. The staff member, who was not licensed to operate the forklift, was using the forklift to assist a subcontractor in moving gas cylinders to ensure adequate gas flow to his instruments over the Thanksgiving holiday. The driver was extricated and hospitalized. Eventually, he recovered from his injuries. The Type A accident investigation board, appointed on November 27, 1995, determined the root cause of the accident to be a lack of controls to ensure that only licensed operators operate forklifts. The board identified eight JONs. The *Type A Investigation Report of a Forklift Accident at Los Alamos National Laboratory on November 22, 1995*, provides more detailed information.

Jackhammer Accident – January 17, 1996: A LANL subcontractor crafts person contacted a 13.2-kilovolt electrical cable in the basement of Building 209 at Technical Area 21 while excavating with a jackhammer. The excavation was part of a waste stream corrections project. The crafts person suffered severe burns and cardiac arrest; he remains in a deep coma. The Type A accident investigation board, appointed on January 23, 1996, identified seven root causes of the accident, including the failure of LANL management systems to correct longstanding, well-defined programmatic weaknesses. The board identified 29 JONs. More detailed information is contained in the *Type A Accident Investigation Report on the January 17, 1996, Electrical Accident with Injury in Building 209, Technical Area 21, Los Alamos National Laboratory*, available on the Office of Oversight home page.

Microwave Accident – July 11, 1996: A LANL student employee received a 4,000-volt electrical shock while conducting electrical measurements on a commercial microwave oven at Technical Area 53, Building MPF-14. The student employee sustained several burns, dislocated both his shoulders, and was hospitalized for eight days. Investigation into the event revealed that a grounding clip was incorrectly connected, creating the unexpected electrical shock hazard. The Type A accident investigation board, convened on July 12, 1996, determined the root causes of the accident to be management’s failure to exercise their responsibility to ensure safety, management’s failure to implement electrical safety requirements uniformly, and the individual’s failure to work safely to protect himself and his coworkers. The board identified eight JONs. More detailed information is contained in the *Type A Accident Investigation Report, July 11, 1996, Electrical Shock at Technical Area 53, Building MPF-14, Los Alamos National Laboratory*, available on the Office of Oversight home page.

Conclusions

The Oversight followup review identified three major conclusions.

AL, LAAO, LANL, and JCNNM are establishing a good foundation for improving safety and establishing the management systems that will help to prevent accidents from recurring.

LANL and JCNNM, in conjunction with AL and LAAO, have implemented or initiated numerous actions to address the weaknesses that contributed to the three accidents that were the subject of this review. In a related effort, LANL also has begun to implement ISM, which encompasses improved systems for establishing standards and requirements and systems for improving safety management at LANL facilities (e.g., the Facility Management Unit approach). Collectively, these efforts provide a good foundation for addressing safety issues and provide the framework for continued improvement in the safety management program. Most notably, Facility Management Units have been established; accountability for safety has been strengthened; and improvements in safety awareness at all levels are evident.

Some of the ongoing efforts, such as effectively establishing roles and responsibilities and implementing the facility management approach at all LANL facilities, will take a year or more to complete according to the ISM milestones. However, ISM provides a good framework for the needed improvements and has the support of LANL and AL/LAAO senior managers. The inclusion of ISM milestones as a contractual performance measure ensures that LANL is accountable for completing needed improvements and that DOE has an effective mechanism for monitoring and evaluating LANL's performance.

Significant deficiencies are still evident in some facilities, particularly in electrical safety and adherence to procedures.

Although progress has been made and many initiatives are under way, much work remains to be accomplished. At this time, the benefits of progress made at the institutional level have not been fully realized at the facility and activity level. Implementation in some facilities and some programs, such as electrical safety, has been slow. Two years after a serious electrical accident, the electrical safety program does not yet provide adequate assurance that electrical work will be performed in accordance with effective procedures at all LANL facilities and activities.

One of the most significant problems identified in the accident investigations, as well as in the Office of Oversight safety management evaluation—deficiencies in developing and adhering to procedures—is still a significant problem at LANL. Procedure adherence problems are a significant hindrance to achieving the objectives and expectations of the new and enhanced work planning and control processes. Failures to follow existing procedures were direct, contributing, or root causes of all three accidents that were the subject of this review.

Other deficiencies that need to be addressed in a timely manner include inconsistencies and discrepancies in the work planning and control procedures, and insufficient rigor in the hazards screening and analysis processes. Training programs also need strengthening to ensure that workers perform activities safely and that managers and supervisors understand their safety responsibilities, including their responsibilities for implementing ISM.

Increased management attention is needed in several areas to ensure that progress is sustained, particularly over the next year as LANL addresses ISM milestones that are critical to satisfactory completion of a number of corrective actions.

While some facilities are making good progress to improve safety management, some of the efforts have not been well coordinated and management support at the facility level has been inconsistent. These factors have resulted in varying levels of performance across the site and merit increased management attention.

The corrective action program also needs increased attention. A formal corrective action program has not yet been institutionalized to ensure an effective approach for corrective action development, prioritization, and closure. As a result, AL, LAAO, and LANL have closed many of the corrective actions before the actions have been completed and verified to be effective.

Several difficult organizational and cultural issues are scheduled to be addressed in the next year as part of the ISM effort. For example, LANL is scheduled to implement the safe work practices and facility safety plan initiatives this year—an effort that will require LANL research and development efforts to adopt a more formal and rigorous approach to safety. Satisfactory completion of a number of the JONs depends on LANL’s ability to effectively implement the ISM program.

In summary, AL, LAAO, and LANL have taken action to address many of the specific problems that led to the three accidents and are implementing ISM to address the need for better safety management systems such that accidents are less likely to recur. These actions, however, have not been uniformly effective at all facilities and all programs. Continued weaknesses in implementation of facility and activity level procedures, particularly in the areas of work planning and electrical safety, leave LANL vulnerable to recurrence of significant events.

The results of this followup review are presented in the following four sections: management systems and worker empowerment; work planning and control; electrical safety; and corrective actions, assessments, lessons learned, and training. Within each section, the JONs associated with that area for the three accidents are grouped into logical categories, and the LANL progress and status of each category is discussed.

At the time of the evaluation, 39 of 45 JONs are considered by LANL, LAAO, and AL to be satisfied and closed. The other JONs remain open pending completion of corrective actions or review and validation by LAAO/AL. The status of each JON is presented in Tables 1-4 of Appendix A. These tables also present the accident investigation followup team's assessment of the status of each JON.

4.1 Management Systems and Worker Empowerment

A number of JONs that resulted from accident investigations for the forklift, jackhammer, and microwave accidents at LANL are related to elements of ES&H management systems and the behavioral aspects of safe work practices. These elements, and related JONs, include:

- Develop and implement Facility Management Units, with strong commitment from LANL management and an institutional mechanism to preserve the integrity of the program (Jackhammer JONs 1 and 3)
- Assign clear roles, responsibilities, and authorities for safety (Forklift JON 8, Microwave JON 6, and Jackhammer JON 2)

- Develop and implement a LANL-wide system for requirements and performance (Forklift JON 1 and Jackhammer JON 3)
- Develop and implement a process for ensuring institutional and individual accountability for safety (Forklift JON 2, Microwave JONs 1 and 2B, and Jackhammer JONs 7, 28, and 29)
- Develop and implement safety awareness systems within JCNNM and LANL (Jackhammer JONs 28 and 29).

Facility Management Units

LANL adopted the Facility Management Unit approach several years ago to emphasize the needs of the operations and to allow the required focus on safety. Currently, LANL upper management recognizes the strategic value of its facilities as a national resource and is committed to the Facility Management Unit approach. As a result, Facility Management Units, including deployed ES&H staff and dedicated crafts, are widely implemented across the LANL site. The approach is generally supported by division managers and is gaining acceptance by mid-level managers.

At this time, all Facility Management Units have completed agreements with their tenants. These agreements are the first step in clarifying the roles and responsibilities of Facility Management organizations in relation to the research and development (R&D) activities. Facility/tenant agreements specifically authorize the Facility Managers to review tenants' activities for cause and/or routinely to determine whether such operations are conducted within the defined facility safety envelope. Conflict resolution processes are also defined in the facility/tenant agreements. Resolution of disagreements between Facility Manager and Group Leaders in charge of research projects involves higher levels of management, including the respective Division Director(s). However, without explicit definition of roles and responsibilities of researchers and institutional requirements that define a work envelope for R&D activities within a facility, negotiations between

Facility Managers and Group Leaders are based on individual relationships and styles. The current process does not ensure that a Facility Manager's concerns and expectations receive appropriate consideration, which was a factor that led to several JONs in the accident investigation reports and has not yet been fully addressed.

Since the inception of the Facility Management Unit approach, the institutional facility management program has provided a useful forum for the interchange of information and ideas among facility managers. Considering the central role of the Facility Management Units and the complexity of organizational and cultural issues faced by LANL, an institutional facility management organization with more explicit authority is needed to focus and routinely resolve strategic and cross-cutting Facility Management Unit-related issues and more aggressively represent the institutional interest of the program.

The "flagship" Facility Management Units (e.g., Technical Area 55) have well-structured organizations, experienced and knowledgeable management teams, and the strong support of the Division Director. However, some Facility Management Units, which span a broad range of sizes, geographical distributions, and operational complexities, do not have the same degree of structure, experience, and management support. Recent decisions by the new LANL Director to undertake organizational realignment to focus operations, and to use the well-functioning Facility Management Units to take over management of additional facilities and assist other organizations, is a conceptually sound approach.



TA 35 includes parts of six different Facility Management Units. Work performed at these facilities includes pulse power, lasers, chemistry, and nonproliferation research.

At those facilities where the Facility Management Unit approach has been fully implemented and accepted by the facility and R&D management (such as Technical Area 55), it has generally been effective in enhancing safety and addressing the JON corrective actions. However, the approach has not yet achieved its objectives at all LANL facilities, and thus the intent of the JONs has not been fully addressed.

Clear Roles, Responsibilities, and Authorities

The Facility Management Unit approach, which includes the separation of facility operations and R&D, has produced a number of new positions and relationships among workers, line managers, program/project leaders, facility owners, facility managers, facility coordinators, and other positions. Many of these relationships have not yet been fully defined, documented, and accepted. For example, the Laboratory Implementation Requirement "Laboratory Facility Management Program" focuses mostly on responsibilities of the Facility Managers and only tangentially addresses the complex interrelation between operations and R&D. Further, confusion in definition of roles and responsibilities is created by documents that are intended for use in the implementation of specific programs, such as work control. Many of these documents, which have already been issued or are in draft form, include definition of roles and responsibilities for similar or identical positions. Since these documents are created by different groups within LANL, the definition of roles and responsibilities contained in them are not well coordinated and are not always consistent.

The roles and responsibilities of many safety-related positions at LANL cannot be fully clarified until new institutional requirements for R&D activities have been developed and documented at a level of detail that allows definition of interfaces between facility and R&D activities. Current plans call for inclusion of this information into Facility Safety Plans by December 1998.

Recognizing the need for more timely definition of roles and responsibilities, LANL issued the "ES&H Roles and Responsibilities—Interim Guidance" in October 1997. This document defines the safety-responsible line management chain and safety responsibilities for facility work, deployed personnel, and programs. This interim guidance is a good step forward that will help bridge the gap until Facility Safety Plans and other such ISM efforts are completed and implemented.

In the area of roles and responsibilities, progress has been made, such as the establishment of Facility Management Units, and the ongoing ISM efforts, such as the Facility Safety Plans, are promising. However, the key ISM efforts needed to fully address the JONs related to roles and responsibilities will require a year to complete according to the current schedule, and much work is needed to implement those efforts at all LANL facilities.

LANL-wide System for Performance and Requirements

The requirements of Appendix F and Appendix G of the DOE-University of California contract, including the “Work Smart” standards (as specified in the contract, LANL uses Work Smart standards as part of their process for identifying contractual ES&H requirements), have been consolidated into an Internal Directive system, which is currently being implemented across the Laboratory. The implementation process is based on a hierarchy of documents that includes:

- Laboratory Performance Requirements—institutional-level performance expectations that cite the Work Smart standards and criteria that all work must meet
- Laboratory Implementation Requirements—institutional-level requirements and responsibilities necessary for implementing Laboratory Performance Requirements
- Laboratory Implementation Guides—institutional-level guidance to be considered for meeting the Laboratory Implementation Requirements.

These documents will ultimately replace the existing system of Laboratory requirements.

The LANL process for defining and developing institutional safety expectations is systematic and well-thought-out. If properly implemented, the approach addresses the issues raised in the JONs related to requirements and performance expectations. However, the effort is still in the early stages of implementation. LANL has made substantial progress toward translating the standards into Laboratory Performance Requirements, but the process for converting Laboratory Performance Requirements into Laboratory Implementation Requirements and Laboratory Implementation Guides is far from complete.

The process for issuing new documents has not been well focused or coordinated. As a result, participation in reviewing the documents and providing comments has not been uniformly strong across LANL organizations. At times, essential individuals, such as facility managers of large Facility Management Units, have opted not to participate, citing obstacles such as a constant barrage of incoming documents and lack of time for conducting meaningful reviews and providing useful comments.

LANL management has recognized that the efforts to issue new documents were not progressing as planned. To improve the process, in December 1997, LANL Facilities, Safeguards, and Security, and Environment, Safety, and Health divisions elected to stop publishing their proposed documents until they finished jointly developing a single, integrated list of prioritized documents and a coordinated schedule for their issuance. In January, the Standards and Requirements Management Board, consisting of four senior managers, was established to oversee the implementation of the program. Elevation of the implementation issues to this level of management is a positive step.

Institutional and Individual Accountability for Safety

Application of the performance-based management process in the form of Appendix F in the DOE-University of California contract is leading to stronger institutional accountability for safety at LANL. Specifically, inclusion of subcontractor management provisions, such as past consideration of ES&H performance in selection of a subcontractor, and the ISM milestones have raised management awareness and improved the visibility of safety at all levels of the organization. For example, Facility Management milestones (including work control) have been incorporated into the contract and are being tracked, verified, and reported to upper management by an internal, independent LANL audit and assessment group. LAAO also monitors these milestones and uses the results for evaluating the effectiveness of LANL against the contract's performance measures. This approach has improved the interaction between DOE and LANL and has provided LAAO with the necessary mechanisms (e.g., Change Control Board and Issue Management Board) to influence LANL to take corrective actions when necessary.

LANL has always had disciplinary policies to correct individual behaviors that were not consistent

with its safety expectations. However, these measures were used rarely, were not defined in enough detail to guide the determination of appropriate actions for supervisors, and when used were not publicized broadly to emphasize that management intentions were serious. Several improvements were observed in this area:

- In the ISM Implementation Plan, LANL has provided specific guidance for supervisors to hold employees accountable for poor safety performance. The “accountability matrix” defines various levels of misconduct and provides guidance for appropriate disciplinary actions for first, second, and third occurrences.
- A LANL-wide process now requires each operating division to prepare a quarterly self-assessment identifying systematic deficiencies, adverse trends, and corrective actions. These self-assessments are consolidated and provided to the LANL Director, and become one of the bases for the Division Directors’ performance evaluations.
- The standards used for performance appraisals of LANL managers include safety measures specific to their operations.
- LANL has taken disciplinary actions against managers and workers for poor safety performance and, within the constraints of privacy laws, has publicized this information.

Accountability for safety has been improved through the DOE-University of California contract and LANL’s willingness to exercise accountability measures in a visible manner. To the extent possible pending full ISM implementation, LANL has effectively implemented actions to improve organizational and individual accountability. However, some aspects of improving accountability of individuals who have important safety responsibilities, such as Facility Managers and Group Leaders, cannot be fully addressed until ongoing ISM initiatives are complete.

Safety Awareness System

Through pilot programs, LANL is currently exploring three different behavioral-based approaches for enhancing safety awareness at three different

organizations within LANL (i.e., Chemistry and Metallurgy Research Facility, Technical Area 55, and Engineering Sciences and Application). LANL is planning to evaluate the results of these pilots, and select an approach appropriate for sitewide incorporation by June 1998. This program is a major component of ISM.

LANL has established a program in which Division Directors and their Group Leaders conduct scheduled walkarounds to enhance safety and promote safety awareness. Some LANL managers have embraced this responsibility and are implementing it effectively. Although the program has promise, it has not yet achieved a uniform level of effectiveness across the site.



TA 3, the main Technical Area, houses about half the LANL workforce and floor space. It includes administrative offices, computing laboratories, physical and earth science laboratories, and the main library and cafeteria.

Since the accidents, considerable effort has been devoted by JCNNM to develop and implement systems to improve their employees’ safety awareness. The centerpiece of JCNNM efforts is a contract with a consulting firm (JMJ Associates) to apply its expertise in behavior-based safety to JCNNM operations. The goal of this effort is to create an “injury-free” workplace, using incentives and disciplinary actions to motivate cultural change. Since the initiation of the contract, the consulting firm has conducted a number of safety workshops to clarify various aspects of safety and is currently involved in coaching JCNNM managers and workers.

A recent outcome of the consulting firm’s activities at JCNNM is the establishment of the Safety Leadership Team. This team includes JCNNM managers (the JCNNM General Manager is a member) and workers, and provides an open forum for management and employees to air their concerns

and to address specific safety issues. The Safety Leadership Team and the JCNNM General Manager walk through construction and maintenance sites on a scheduled basis to promote acceptance of change in safety culture. JCNNM has established and is implementing a system for rewarding and penalizing employees for safety performance.

Both LANL and JCNNM have taken action to raise safety awareness. For example, LANL and JCNNM personnel indicated that they would not hesitate to stop work if circumstances warrant, and that they did not fear management retribution if they were to do so. As a result of the commitment by senior management and application of behavior-based safety programs, improvements in safety awareness at JCNNM are evident. LANL's efforts are ongoing but are not expected to be completed until late in 1998, according to the ISM implementation schedule.

Summary Assessment

Correcting management system deficiencies and effecting behavioral change, as required by the JONs, necessitate development, implementation, and execution of complex processes. Even though the ISM program at LANL has embraced the management system and worker empowerment issues, development and especially implementation of programs for ultimate resolution of these issues are currently not in place, as evidenced by the ISM milestones.

Progress has been made in many of these areas, and LANL programs are moving in the right direction. Some facilities have made much progress and have met the intent of the JONs, while others have not yet done so. Although much work remains to be accomplished, LANL managers have a good understanding of the current status and have ongoing programs that are designed to address the JONs across the site. LANL managers also have monitored progress and recognized problems, such as the need to re-evaluate the processes for developing and issuing safety documents, and have been taking action to correct them.

4.2 Work Planning and Control

The accident investigations identified 13 JONs directly related to work planning and control. Section 4.3 provides information about other JONs that primarily relate to electrical safety but that also indicate work planning and control weaknesses. For the purposes of this review, the JONs directly related to work planning and control have been categorized into the following areas:

- Establish and implement institutional and facility-specific work control programs to ensure that hazard controls are effective across the LANL site, including controls that apply to activities such as construction and maintenance (Jackhammer JONs 5, 10, and 24; Microwave JON 8)
- Establish and implement systematic and formal methods for identifying and analyzing hazards and risks using a graded approach (Jackhammer JONs 8, 9, and 11, Forklift JON 7)
- Establish work controls to address potential hazards associated with forklift operations (Forklift JONs 3, 4, 5, and 6)
- Develop and implement a process to confirm that Laboratory-wide actions, such as stop-work orders, are communicated, received, and verified to be in place (Jackhammer JON 6).

Institutional and Facility Work Controls

Many of the JONs for the jackhammer accident addressed various aspects of the need for institutionalization of work planning and control processes. The JONs for the microwave accident also indicated problems with developing work controls and following institutional and/or facility-specific procedures during R&D activities. Similar concerns were noted in the forklift accident.

To address these JONs, LANL has developed and implemented new institutional procedures that are moving LANL work practices closer to uniform expectations and performance. LANL has issued Laboratory Implementation Requirements for facility work control and hazard analysis and control. Subsequently, these procedures have been revised and additional institutional processes have been issued to delineate requirements for maintenance "skill of the craft" and the graded approach to facility work. Additional requirements documents, in draft or planning stages, are scheduled for issue, including construction project management and additional safe work practices (for R&D work control process) procedures. Although much work remains to be accomplished to ensure that the institutional and facility-specific work controls are fully implemented and verified to be effective, the enhancements to institutional procedures have resulted in improvements in many areas.

As part of the effort to improve institutional work planning and control, LANL has taken a number of actions that have proven effective in enhancing communications and controlling work activities. For example, LANL has established the Facility Management Unit teams and facility coordinators and has deployed ES&H teams to the facilities. The LANL personnel work with the JCNNM Zone Manager and work scheduler to improve coordination of activities. Communications in LANL facilities also have been enhanced through mechanisms such as the plan-of-the-day meetings, plan-of-the-week meetings, pre-job briefings, and job walkdowns. Such efforts have helped to increase awareness of day-to-day facility operations/activities.

Although progress has been and is being made at the institutional level, the work planning and control program has not yet achieved an appropriate level of effectiveness at all facilities. The processes for and effectiveness of preparing, authorizing, and documenting work activities vary among Facility Management Units. Many of the work control problems result from an absence of work control implementing procedures. Several Facility Management Units and work provider organizations had not yet developed, or recognized a need to develop, implementing procedures for the institutional work planning and control procedures (ten months after their initial issue in February 1997).

One of the most significant problems identified in the accident investigations as well as the Office of Oversight safety management evaluation—deficiencies in developing and adhering to procedures—is still a significant problem at LANL. Multiple errors, omissions, and failures to follow procedures were identified in many procedures and completed work packages. Such procedure adherence problems are a significant hindrance to achieving the objectives and expectations of the new and enhanced work planning and control processes. As described in the Type A investigations, failures to follow existing procedures were direct, contributing, or root causes of all three accidents that were the subject of this review. Some of the LANL work planning and control weaknesses are delineated in the text box on page 11.

Although deficiencies remain to be addressed, LANL, JCNNM, and subcontractors have made progress in facility work control programs, such as construction and maintenance, that are performed primarily by technicians and craft workers. LANL has not yet devoted the same level of attention to

its R&D activities, which are typically performed by scientists and engineers. Correspondingly, the work planning and control processes for R&D work are not well developed at either the institutional or the facility level. Recently, some progress in developing an institutional work control program for R&D activities has been achieved, such as issuance of the Laboratory Implementation Requirement on Safe Work Practices, and a number of initiatives are under way. Although the new institutional work control program for R&D work activities has only recently been created, an aggressive schedule has been established for developing additional Laboratory Implementation Requirements and Laboratory Implementation Guides and for training appropriate research personnel in accordance with the safe work practice program criteria by the end of 1998. Because it is in the early stages, the work control program for R&D work could not be evaluated. It does however, present significant challenges for LANL and requires close monitoring and oversight.

Hazards Identification and Analysis

As a result of LANL's corrective actions, hazards identification and analysis for facility work at LANL have improved. At the institutional level, new Laboratory Implementation Requirements and Laboratory Implementation Guides have been issued for hazards analysis and control of facility work, maintenance skill of the craft, and a graded approach for facility work. At the facility level, LANL Facility Management Units have enhanced their work planning activities and have been more rigorous in performing hazard screens and hazards analyses of work activities. Corrective actions also have been effective in reducing the number and potential misuse of standing work orders.

Notwithstanding these accomplishments, the processes and procedures are still not sufficiently rigorous to ensure that hazards are consistently identified and controlled. For example, the work control and hazards analysis Laboratory Implementation Requirements and Laboratory Implementation Guides do not specify any time limits for which completed hazard screens are valid, nor do they address the use of and requirements for standing hazard screens. The hazards analysis and control Laboratory Implementation Requirement and the implementing procedures do not require authorized/qualified persons to verify and document, at the time work is authorized, that existing standing hazard screens and activity

Work Planning and Control Weaknesses

- Few work control implementing procedures at the facility and work provider levels that document the work control process or the Facility Manager's expectations for control of work
- Work requests, hazard screens, and work authorizations documented on a variety of forms, few of which have instructions or procedures
- Facility work activities performed by contractors other than JCNNM or by LANL service groups (such as the LANL group that performs installation and maintenance of security and fire protection systems) still handled in a different manner from maintenance activities conducted by JCNNM
- JCNNM procedures have not been updated and conflict with LANL or Facility Management Unit procedures in areas such as forklift use, stop-work, and special work permits
- Failures to follow procedures observed in work control documents and practices (e.g., craft supervisors authorizing and accepting work for Facility Managers), and implementing Lab Implementation Requirements (e.g., Forklift Lab Implementation Requirement)
- Misleading instructions (i.e., activity hazards analysis for skill of the craft) resulting in procedural non-compliances
- Inattention to detail in completing work control documents (missing dates, incomplete forms, and unsigned lockout, tagout, and JCNNM electrical work forms)
- Incorrect application of skill of the craft among the Facility Management Units, leading to hazards analyses that do not appropriately identify hazards associated with a specific work activity
- Inadequate descriptions of work and delineation of work steps
- Work provider confusion between site and work activity hazards and controls, and the appropriate mechanism to distinguish and document each
- Job-specific activity hazards analyses with numerous "if needed" controls
- "Triggers" for involving ES&H in the hazards analysis or hazards analysis revision process not well defined
- Pre-job briefings and/or job site walkthroughs prior to commencing the work activity not documented and not consistently performed
- Poorly defined training and qualification requirements for individuals performing hazard screens and authorizing work
- No institutional computerized work control system in place; several Facility Management Units are independently constructing their own computerized work control systems

hazards analyses are still sufficient. Likewise, LANL procedures do not specify that the performance of pre-job briefings and/or job-site walkdowns be documented. Further, the thresholds for involvement of LANL and JCNNM ES&H professionals in hazard reviews and analyses are not well defined in procedures. ES&H screenings are performed exclusively by building managers, and activity hazards analyses primarily are prepared by maintenance supervisors. Few facility maintenance and minor modification activity hazards analyses or screens are reviewed by or concurred with by ES&H personnel, although ES&H may be involved in specifying hazard controls for some work activities. ES&H personnel review and concur with all activity hazards analyses for new construction.

The implementation of hazard screens and controls varies across Facility Management Units and, in some cases, such as work designated as "skill of the craft," hazards analyses are not always tailored to the work activity. The standing activity hazards analyses contained numerous general hazards, many of which did not apply to specific work activities. In some cases, standing activity hazards analyses were being customized by craft supervisors to suit site- and job-specific conditions; this practice was inconsistent with the concept of skill of the craft and sometimes inaccurately performed. In addition, the use of standing ES&H

hazard screenings and standing activity hazards analyses for some jobs (such as JCNNM core preventive maintenance, skill of the craft work, and preventive and corrective maintenance) appears to permit work without current and job-specific ES&H reviews; thus, the intent of the JONs that related to standing work orders has not been fully addressed. These weaknesses, combined with the weaknesses in procedures, result in many instances where workers could be performing work that has not had sufficient Facility Manager, supervisory, and/or ES&H reviews of site conditions and hazards to ensure that existing controls are adequate.

Forklift Work Controls

Since the 1995 forklift accident, LANL has taken actions to improve assignment of responsibilities for forklifts, forklift access controls, forklift restraint systems, identification and communication of forklift ownership, and hazard recognition during forklift operations. For example, LANL has developed a new Laboratory Implementation Requirement on forklifts, revamped the forklift training program to include operator certification for specific forklift types and a requirement for a field proficiency evaluation, developed a sitewide forklift inventory, developed a policy on seat belt usage, and retrofitted forklifts with seat belts.

Although all of the work planning and control-related forklift JONs have been completed by LANL and verified as closed by AL/LAAO, the corrective actions have not been fully effective in resolving the issues identified in the JONs. For several of the Forklift JONs, the corrective actions were completed, and yet based on field observations, the fundamental issue(s) identified in the JON have not been satisfied due to inadequate program implementation or program maintenance in the field. For example, the proposed corrective action to Forklift JON 6 was to post information on all forklifts concerning ownership data, inspection records, authorized operators, etc. In 1996, ESH-5 implemented a site-wide inventory and placarding of forklifts, and validated that such information had been posted on each forklift. However, the evaluation team observed that this information was no longer legible on many of the forklifts, most likely due to weathering of the original placards. As a result, when the team identified a forklift with the keys in the ignition, the team and LANL representative were unable to readily identify the owner or authorized operator of the forklift, which was the issue identified in the JON. Similarly, some responsibilities assigned in the Forklift Laboratory Implementation Requirements to Facility Managers and proficiency instructors were not being implemented as written. Hazard recognition was included in the new forklift training fundamentals course and in the operator evaluation checklist in accordance with another forklift JON; however, site-specific hazards analysis training is not being adequately addressed by some forklift proficiency instructors nor adequately documented within the work planning documents.

Most LANL groups sampled were attempting to implement an operator inspection program; however, the implementation of the policies for inspection (e.g., prior to each use, once per shift) and completed inspection documentation varied among the groups. A few groups had not been performing the required forklift inspections, and there were several instances where pre-use inspections had not been performed or documented for operating forklifts. Each LANL group has documented their method of forklift access control. However, the discovery of keys in one unattended forklift, combined with an illegible placard in which the forklift owner's name could not be discerned, raises questions about the implementation effectiveness of the new forklift access control program. Since the team's sample of forklifts was

small, LANL should determine if the aforementioned concerns were isolated cases or indicative of forklift program implementation deficiencies on a divisional or institutional level.

Stop-Work Policy

In response to issues associated with the jackhammer accident, LANL has revised its procedure for stopping work in the event that LANL personnel notice a potentially unsafe condition. LANL and AL have closed this JON because a new stop-work procedure (the Laboratory Implementation Requirement on Stop-Work and Restart) has been issued (March 28, 1997); however, the procedure remains deficient, and implementation of the procedure was inconsistent. The revised LANL stop-work procedure does not fully address some important elements of a comprehensive stop-work policy, and some aspects are not clearly defined. For example, the procedure does not define "imminent danger" or require notification of Facility Managers and the safety organization for stop-work actions. In addition to procedural weaknesses, LANL has not ensured that personnel are aware of the stop-work procedure and trained to implement it. Although the procedure had been in effect for more than nine months, evaluators found that some management and supervisory personnel, including the Laboratory and a divisional electrical safety officer, were unaware of the new procedure.

The JCNNM stop-work procedure was out of date (last updated in July 1988) and was not consistent with the LANL procedures. The LANL Business Division has taken some actions to notify subcontractors about the stop-work policy, including ensuring that all construction subcontracts issued since March 1997 contain a special contractual provision for stop work. However, these actions did not provide for feedback to ensure that Laboratory-wide actions such as stop-work policies are understood and implemented.

Summary Assessment

For some facilities and some programs, corrective actions taken to address work planning and control JONs, along with other organizational and process changes, have resulted in improvements in the planning and control of facility-related work activities at LANL. However, the improvements in institutional programs have not yet been effectively

implemented across the LANL site. Work control process weaknesses and implementation discrepancies are still apparent, particularly in procedure adherence and implementation, the application of hazards analysis, and implementation of stop-work policies.

4.3 Electrical Safety

Two of the accidents that are the subject of this Oversight followup review—the January 17, 1996, jackhammer accident and the July 11, 1996, microwave accident—identified seven JONs directly relevant to the LANL electrical safety program. For the purposes of this report, the electrical safety JONs have been summarized and grouped as follows:

- Develop and implement a formal electrical safety program to ensure that activities involving energized equipment are conducted safely and with the appropriate level of management and ES&H review and approval (Jackhammer JON 16 and Microwave JON 3)
- Revise laboratory procedures on penetration and excavation to include use of the permitting process for all penetrations and to improve drawing reviews, walkdowns, and surveys as part of the permitting process (Jackhammer JON 12)
- Assess the critical power requirements for nuclear facilities and prepare plans and procedures for providing temporary/emergency electrical power (Jackhammer JON 13)
- Clearly identify and specify personal protective equipment requirements for electrical work, and specify measures for tracking and testing personal protective equipment (Jackhammer JONs 14 and 15)
- Correct deficiencies in electrical safety training in one Los Alamos Neutron Science Center group (LANSCE 9) and review the training status of other groups within the division (Microwave JON 7).

Electrical Safety Program

After experiencing a number of significant delays, LANL developed a formal institutional electrical safety program, which is documented by both a Laboratory Implementation Requirement and a Laboratory Implementation Guide, which provides an adequate basis for the LANL electrical safety program. As part of this effort, LANL evaluated their program against the DOE model electrical safety program that resulted in strengthening certain aspects of LANL electrical safety procedures. There was a significant delay, however, in the establishment of the Laboratory Electrical Safety Committee and in clarification of the Authority-Having-Jurisdiction, which resulted in implementation delays for some aspects of the program. Recently, the electrical safety program has been included within the framework of the ISM, which increases its visibility and also ensures that electrical safety is addressed by the ISM milestones and performance measures delineated in the DOE-University of California contract.

As part of the electrical safety program, LANL has established several effective mechanisms for communicating and resolving electrical safety issues. These mechanisms include the Electrical Safety Committee and the use of Laboratory, Division, and Group Electrical Safety Officers. The Electrical Safety Committee meetings are effectively used as an open, non-punitive forum to discuss and resolve electrical safety issues. All LANL organizations performing significant electrical work are represented on the committee, including the electrical union and subcontractors. The Committee has been reviewing significant issues, such as how to invoke and document Authority-Having-Jurisdiction determinations. To establish a baseline, the Committee is in the process of categorizing and revalidating all previous Authority-Having-Jurisdiction electrical code interpretations to ensure consistent application of electrical safety requirements across the site.

Although progress has been made, the electrical safety program has not yet been effectively implemented across all LANL divisions. A few divisions, such as the Los Alamos Neutron Science Center, Nonproliferation and International Security, and Dynamic Experimentation Divisions, are well along in implementing the institutional electrical safety program; these divisions have reviewed current electrical operations and established Safe Operating

Procedures and Safe Electrical Work Permits. Other divisions have not progressed as far and do not yet have effective electrical safety programs in place. Delays in establishing LANL's Electrical Safety Committee and a lack of LANL senior management commitment contributed to delays in implementing effective programs at all the facilities and activity level.

A review of selected Safe Electrical Work Permits and completed lockout/tagout forms at the Engineering Sciences and Applications Division indicated numerous failures to follow procedures in completing electrical work requests and lockout/tagout documents; procedure adherence continues to be a problem in electrical safety, as well as in other aspects of LANL operations (see Section 4.2). The review also indicated that the Division Electrical Safety Officer was not reviewing most Safe Electrical Work Permits. Because failure to follow approved procedures was a common thread in the two electrical-related accidents, it is particularly important that sustained management attention be focused on ensuring that personnel adhere to electrical safety procedures.

Because LANL has established a formal institutional electrical safety program, both LANL and AL/LAO have accepted the corrective action and closed the applicable JON. However, the corrective actions have not yet ensured that the formal electrical safety program has been fully implemented and is effective at the facility and activity level. In recent months, LAO has recognized a need for increased commitment of senior management to ensure implementation of the electrical safety program. An electrical safety review conducted by LAO in November 1997 characterized the status of implementation of the electrical safety program as "varied with few divisions aggressively attempting to meet the requirements" and recommended that the Laboratory re-establish an implementation schedule to expedite program implementation Laboratory-wide.

Penetration Permits

The jackhammer accident demonstrated the need to revise Laboratory procedures to delineate and emphasize requirements for permits for penetrations or excavations. The applicable JONs specify the need for such permits outside or inside buildings whenever groundbreaking or cutting into walls or floors is to be performed, and specify a review of drawings, physical walkdowns, and surveys as part of the permitting process.

JCNNM has appropriately addressed the need for enhanced penetration procedures by revising several procedures (including procedures on Excavation/Soil Disturbance Permit Process; Penetrating Ceiling, Wall, Floor, and Concrete Surfaces; and Locating and Marking Underground Utilities). The JCNNM procedures now require a review of drawings, walkdowns, and surveys as part of the permitting process.

Although LANL and AL have listed this issue as closed, LANL has not systematically and effectively addressed the issue of penetration/excavation permits as they apply to LANL employees and LANL's other subcontractors. LANL did not develop or revise institutional penetration and excavation procedures. For example, one procedure (the Administrative Requirement Procedure on Excavation or Fill Permit Review, October 1991) was not revised and does not contain specific requirements on penetrations for LANL employees and direct subcontractors. Another procedure (the Laboratory Implementation Requirement on Electrical Safety) contains requirements for electrical penetrations but does not address excavation permits, authorization approvals, or documentation requirements. Lacking institutional procedures, some divisions have developed penetration and excavation procedures for their facilities; therefore, penetrations and excavations may be performed to differing requirements across the site.

Emergency Power

The jackhammer accident caused a disruption of electrical power in the building where the accident occurred (Technical Area 21, Building 209). In some circumstances, such a disruption in electrical power can affect the operability of safety-related systems (e.g., ventilation and filtering systems that are needed to mitigate an unintended release of hazardous materials). Accordingly, one JON specified that LANL management needed to assess the critical power requirements for Technical Area 21, Building 209 and other nuclear facilities and to prepare plans for providing temporary power as appropriate. As the maintenance contractor for LANL, JCNNM is responsible for maintaining and repairing electrical power systems and thus has primary responsibility for implementing corrective actions involving temporary power.

JCNNM actions to date have partially addressed the need to ensure that temporary electric power is available to critical equipment in the event of an

accidental disruption. JCNNM has revised the applicable procedure (Backup Generator Systems Maintenance, Repair, and Testing) to include an attachment that addresses temporary generator hookup requirements. The attachment gives basic information on generators available, cable sizing versus amperage, and general precautions on cable routing, grounding, and connections. However, the revision to the procedure does not fully meet the intent of providing plans for temporary power as stated in the JON. For example, it does not address factors such as generator or cable storage locations or details regarding connection of power to specific buildings. LANL personnel indicated that temporary power plans were about 40 percent complete. However, all action to finish this process and complete temporary power plans was halted due to funding and personnel constraints. When Facility Management Units were established, the responsible LANL group (Facility Engineering Services) lost all funding to complete the process. Thus, AL, LAAO, and LANL closed this JON before all the actions have been completed and verified to be effective.



TA 21 houses the Tritium Science and Fabrication Facility, which supports research and development, and the Tritium Systems Test Facility, which supports fusion fuel system development. The western portion of TA 21 is partially vacant and undergoing limited decommissioning.

Personal Protective Equipment

Based on a review of personal protective equipment for electrical work, improvement in handling and testing of personal protective

equipment is evident. JCNNM has established a database to issue, track, test, and retest electrical personal protective equipment. Users have been trained on the inspection, use, and care of personal protective equipment. Records show the testing status and inspection dates of personal protective equipment.

Electrical Safety Training

The microwave accident highlighted weaknesses in the training programs for one of the groups (LANSCE 9) in the Los Alamos Neutron Science Center. The applicable JON specified a need to correct deficiencies in the electrical safety training program for that group and to review the status of training in other groups within the division.

LANL's corrective actions have been generally effective in addressing the need for training within the Los Alamos Neutron Science Center. LANL completed electrical safety training/retraining of LANSCE 9 personnel in September 1996, performs monthly monitoring of training status, and implemented a system for documenting on-the-job training (OJT) in electrical safety. Training compliance, which was about 70 percent at the time of the accident, has improved to about 95 percent for the Los Alamos Neutron Science Center.

In addition, the Los Alamos Neutron Science Center training office developed and is implementing a formal procedure for OJT. The procedure provides for three levels of OJT, depending on the complexity and risk of the work activity, and a course has been developed to teach OJT trainers how to perform OJT effectively. Although a positive step, OJT assignments for electrical work procedures in some groups (LANSCE 8 and LANSCE 9) may be non-conservative, considering the risk of not performing the procedures correctly.

Summary Assessment

Since the two Type A electrical accidents in 1996, AL, LAAO, LANL, and JCNNM have implemented a number of program enhancements, including development of a formal institutional electrical safety program, enhancement of some procedures, establishment of an effective training program for selected LANL personnel, and improvements in the availability and reliability of personal protective equipment. Although actions to improve the program are ongoing, the electrical



TA 53, the Los Alamos Neutron Science Center (LANSCE), produces proton and neutron beams to support national security and civilian research.

safety program does not yet provide adequate assurance that electrical work will be performed in accordance with effective procedures at all LANL facilities and activities. Continued weaknesses in the electrical safety program leave LANL vulnerable to recurrence of significant events.

4.4 Corrective Actions, Assessments, Lessons Learned, and Training

The investigations of the jackhammer and microwave accidents specifically identified JONs in the areas of corrective action programs, self-assessment, lessons learned processes, and training. For the purposes of this review, the JONs have been summarized and grouped into the following areas:

- Enhance corrective action programs to ensure that corrective actions identified during accident investigations are developed, implemented, and tracked to closure (Jackhammer JON 21 and Microwave JON 2A)
- Perform assessments (including LANL internal assessments, LAAO assessments and day-to-day monitoring of LANL performance, and AL oversight of LANL performance) to ensure compliance and effective performance and to identify deficiencies and bring them to the attention of appropriate managers for timely correction (Jackhammer JONs 17, 19, and 20 and Microwave JON 5)

- Routinely analyze data from occurrence reports, assessments, and other sources to identify lessons learned and apply them across the LANL site (Jackhammer JONs 18 and 27 and Microwave JON 2B)
- Evaluate and enhance training programs for LAAO, LANL, and JCNM personnel to ensure that persons involved in hazardous or safety-related operations are trained and qualified and that safety processes and requirements are an integral part of training programs (Jackhammer JONs 22, 23, 25, and 26 and Microwave JON 4).

Corrective Actions

The ultimate goal of the accident investigation program is to prevent recurrences of similar types of accidents. Appropriate corrective actions must be planned, scheduled, implemented, tracked to completion, and then evaluated for effectiveness to ensure that program and process improvements are implemented that fully address the JONs identified by the accident investigations. The scope of this Followup Review, as identified in the Followup Plan for the LANL Site Visit (forwarded on November 12, 1997) and as required by DOE Order 225.1A, Accident Investigations, was to evaluate the completion of approved corrective actions and the implementation of those corrective actions to satisfy the JONs for the three referenced accidents.

AL, LAAO, and LANL have made substantial progress toward implementing corrective actions in response to the 45 JONs identified in the three accident investigation reports that were the focus of this Oversight review. According to AL, LAAO, and LANL records, the vast majority of the approved corrective actions have been completed and most JONs have been closed. The tables in Appendix A of this report provide a summary of the JONs; the status of the corrective actions according to AL, LAAO, and LANL records; and the Oversight accident investigation followup team's evaluation of the JONs. The team's evaluation categorized each JON as being fully satisfied, corrective actions complete but not effective, not fully satisfied, open, or ongoing under ISM. As discussed throughout

this report, the approved corrective actions that were implemented were, at times, not complete (e.g., Jackhammer JON 13 for temporary emergency power) or not comprehensive (e.g., Jackhammer JON 23 for evaluating training effectiveness). Further, AL, LAAO, and LANL did not verify in all instances the effectiveness of the corrective action before closing the JONs.

One of the primary factors contributing to the identified weaknesses in effectively implementing and verifying corrective actions is that neither AL/LAAO nor LANL has established effective formal procedures that ensure an effective and consistent approach to a corrective action program. For example, the current LANL procedures do not adequately address: corrective action development, in particular, the basis and criteria for corrective action closure and verification of effectiveness; priorities; requirements for timeliness; or integration of similar corrective actions from various assessment sources (e.g., linking accident investigation JONs to ISM action items). AL and LAAO have held periodic meetings and have teamed with LANL to improve the effectiveness of corrective action development, tracking, and closure. However, the roles and interfaces among AL, LAAO, and LANL with respect to closing corrective actions are not clearly defined or not formally documented.

AL, LAAO, and LANL personnel have indicated that some of the corrective actions for the accident investigation JONs have been encompassed by the ongoing development of the ISM program at LANL. Consequently, LANL indicated that they closed certain JONs after the short-term actions were completed because they believed that the longer-term actions, such as development of institutional programs, were adequately covered by the ISM actions and milestones. During the Oversight evaluation, LANL developed a “crosswalk” between the accident investigation JONs and the ISM actions, demonstrating that some of the JONs correspond to ongoing ISM actions. However, until the crosswalk was prepared, LANL had no clear linkage between the tracking systems for the JONs and the tracking systems for ISM actions. Without this linkage, there can be no assurance that the corrective actions being implemented in the ISM adequately satisfy the requirements of the JONs. For example, corrective actions to address JONs involving assessments of the Facility Management Unit process, which identified institutional gaps and implementation of an institutional work control

process, were closed before they were verified to be complete and effective. Although closed according to both the accident investigation database and the LANL “crosswalk” provided, some of the ISM actions needed to fully address the JONs still are ongoing based on discussions with LANL personnel, and need to be tracked, monitored, and verified under the auspices of ISM (refer to Appendix A, Table 1, which relates to implementation of management systems).

Excluding JONs where corrective actions are ongoing under the auspices of ISM, a significant number of JONs were “closed” by AL, LAAO, and LANL before they had been completed and/or verified to be effective, demonstrating weaknesses in the accident investigation JON corrective action process, in several areas, including:

- *Timeliness:* Corrective actions were listed as “on schedule” even though the accidents occurred more than a year ago (e.g., Jackhammer JON 24 and 19, and Microwave JON 2A). Action has not been completed regarding the training of emergency medical technicians because of delays in the proper assignment of responsibility for Jackhammer JON 26.
- *Closure:* Corrective actions were closed based on the transfer of the action from one JON to another (e.g., Forklift JON 2), or to the ISM tracking system (see Table 1 Appendix A), without adequately identifying, coordinating, and documenting the needed actions.
- *Completion:* LANL accepted the completion of some corrective actions without adequately verifying that they were effectively implemented (e.g., Jackhammer JONs 6, 10, and 23).
- *Verification:* AL/LAAO did not ensure that corrective actions requiring implementation (e.g., Forklift JONs 3 and 4, Jackhammer JON 16) were effective prior to closing the JON.

LANL has recognized the need for an integrated data management and analysis system to track corrective actions from various sources. A comprehensive integrated data management and analysis system has been developed for use by

LANL's assessment organization. AL/LAAO has developed and implemented a separate database (called AIMS) for monitoring the status of corrective actions for accident investigations. Both of these systems have the potential for maintaining a clear and current status of all corrective actions and communicating that information to responsible managers and supervisors.

Although the accident investigation corrective action process needs improvement, it is notable that AL and LAAO have become increasingly involved in and taken "ownership" for the corrective action process for accident investigations.

Assessments

Since the three accidents occurred, AL/LAAO and LANL have established or enhanced many assessment processes. LANL self-assessment activities have been structured through the approved Laboratory Implementation Requirement for "Safety Self-Assessment." This procedure identifies requirements for conducting quarterly line management self-assessments and semi-annual safety functional manager assessments to ensure that appropriate managers examine key ES&H topics in their division or functional area; such assessments have the potential to promote Laboratory-wide improvements. In addition, a management safety walkaround program has been formalized to ensure that line managers perform frequent (monthly) reviews to identify specific safety deficiencies or workplace problems and noteworthy practices.

Most of the LANL self-assessments performed by the Safety Function Managers and the Division Directors are in the early stages of implementation and have not yet achieved consistent quality and detail. These newly formalized assessment processes have not been in place long enough to determine their effectiveness.

The LANL independent Audits and Assessments Group recently completed assessments of facility/tenant owner agreements, forklift operations, work control, and self-assessments that were comprehensive and thorough. To enhance their assessment program, the LANL Audits and Assessment Group has established a risk-based assessment schedule for FY 1998 that covers both institutional and facility-specific topics. In the absence of an effective corrective actions process, however, the findings and recommendation of LANL assessments do not always result in improvements that remain effective.

Lessons Learned

In the past 18 months, LANL and JCNNM have taken some actions to improve their lessons learned programs. For example, LANL has established an effective, although informal, process for communicating lessons learned about significant occurrences to senior managers. In addition, LANL has developed a lessons learned package addressing four recent accidents. This package has been disseminated widely within LANL and provides useful information.

JCNNM is publishing and disseminating lessons learned bulletins to communicate lessons learned throughout their workforce. These bulletins are analytical, well-thought-out, and written for the appropriate level of the workforce with thought-provoking practical exercises. This process could be a model for a Laboratory-wide application.

Although these recent actions are promising, LANL and JCNNM have not yet established systematic and formal lessons learned processes, including feedback mechanisms, to ensure that lessons learned are translated to effective corrective actions and implemented by management to prevent a recurrence. The current LANL processes provide some useful information on occurrences to senior managers but do not include other important sources of information. In addition, LANL does not have a formalized institutional program that provides ongoing lessons learned down to the worker level. These weaknesses in the lessons learned program are recognized by LANL. Correspondingly, one of the relevant JONs remains open.

Training

Training at LANL is primarily the responsibility of line management (i.e., line managers are responsible for identifying who needs to be trained and what that training should include). Within LANL, some divisions have established effective training and qualification programs for some topical areas. For example, the electrical safety training within the Los Alamos Neutron Science Center has generally been effective and responsive to the JON corrective action (see Section 4.3). JCNNM has enhanced their training program by providing additional training and establishing processes for incorporating lessons learned and assessment results into their training programs. Further, consolidating the JCNNM and LANL training databases and formalizing the reviews of safety requirements as

part of the planning for JCNNM training were identified as significant process enhancements.

Although there have been some instances within LANL where the training and qualification programs are effective, LANL and JCNNM have not adequately addressed some important aspects of the corrective actions related to training JONs. LANL has not evaluated the effectiveness of JCNNM training by measuring workplace performance, which was required by one of the JONs. While both LANL and JCNNM have mechanisms in place for measuring the value of training provided, neither has established a process to measure workplace performance that will evaluate the effectiveness of training. In a self-assessment of institutional ES&H training, LANL evaluated the effectiveness of certification training for radiological control technicians but did not evaluate the effectiveness of training provided in any other safety areas, such as electrical safety, work control, forklift operations, fitness for duty, or on-the-job training. Both JCNNM and the LANL Training Integration Office acknowledged the need for and value of this type of evaluation.

Some Laboratory Implementation Requirements and Guides have been promulgated with little or no training to ensure consistent implementation. LANL has not actively evaluated the need for training to effectively implement the numerous Requirements and Guides that have been recently issued. In addition, a consistent institutional approach has not been used for training on safety-related Laboratory Implementation Requirements that cut across the LANL site, such as work control and stop-work policy. Because such Laboratory Implementation Requirements often involve interfaces between organizations and/or the same personnel working at different facilities (e.g., JCNNM central craft personnel), a consistent approach and common understanding of these requirements are important.

The LANL training programs have not ensured that personnel in the Facility Management Units and support organizations have a full understanding of the expectations and requirements of the institutional work control and hazards analysis procedures. This has resulted in inconsistent interpretations and application. Personnel were unclear about the hazards to be identified by the

initial ES&H screenings, skill-of-the-craft definitions and qualifications, standing activity hazards analyses, and graded-approach criteria. For example, the definition and qualification requirements to become an “authorized” person to perform hazard screenings are not consistently or thoroughly delineated in procedures. Further, the skill-of-the-craft training requirements identified in standing activity hazards analyses are not clearly specified, can be cumbersome (e.g., JCNNM foremen need to compare up to 15 different items to the LANL training database to determine whether an individual is qualified), and are not correlated directly with specific training classes (e.g., personal protective equipment).

Summary Assessment

In response to the JONs from the three accidents, AL, LAAO, LANL, and JCNNM have taken a number of actions to enhance various aspects of corrective action programs, assessments, lessons learned, and training programs. Some of these actions have been effective, and others are promising but in the early stages of implementation. Most of the corrective actions for the JONs are identified as completed by LANL and closed by LAAO and AL. However, the corrective action processes have not been effective in fully resolving identified issues and verifying corrective action implementation.

With the recent enhancements, LANL has many of the elements of an effective program for ensuring safety and preventing accidents from recurring. However, some of these elements are not yet mature and are not effectively coordinated. For example, the corrective action tracking and closure process does not formally establish mechanisms and criteria for corrective action development, prioritization, accountability, and basis for closure. In addition, the training programs do not ensure that personnel understand their safety responsibilities and the new and often complex procedures associated with ISM. In general, the corrective action programs, lessons learned programs, assessments, and training programs are not yet sufficiently formalized, institutionalized, and coordinated to provide a systematic and continuous method for preventing accidents from recurring.

Appendix A

Judgments of Need

Table 1 — Judgments of Need: Management Systems and Worker Empowerment			
JON	Judgment of Need	Site Status	Accident Investigation Followup Status and Evaluation
<i>Forklift</i> JON 1	Develop and implement a system to provide uniform application of safety requirements and performance.	Closed	<p>Actions ongoing under ISM.</p> <ul style="list-style-type: none"> • Applicable lab standards have been defined, and most have been translated into Lab Performance Reports (LPRs). • The process for converting LPRs into Lab Implementation Requirements (LIRs) and Lab Implementation Guides (LIGs) is being implemented, but lacks consistency and direction. • Final ISM milestones scheduled for January 1999.
<i>Forklift</i> JON 2	Ensure that safety policies and procedures are uniformly enforced.	Closed	<p>JON fully satisfied.</p> <ul style="list-style-type: none"> • Evidence files show that 709 site managers received training in “Essentials of Supervisors,” which dealt with good safety practices and disciplinary policies and actions related to working unsafely. • Related corrective actions were completed under Microwave JON 1 regarding employee accountability for safety and consequences for poor safety performance. • The Fitness for Duty program has been added to the General Employee Training under the corrective actions for Microwave JON 4.
<i>Forklift</i> JON 8	In developing and implementing the facility management responsibilities, assure complete and uniform coverage.	Closed	<p>Actions ongoing under ISM.</p> <ul style="list-style-type: none"> • Facility management “off ramp” requirements for ISM have been incorporated in the UC contract. • FMUs, including deployed ESH staff and dedicated crafts, have been implemented across LANL. • Assurance of complete and uniform safety coverage is contingent upon successful implementation of LIRs/LIGs for R&D work (e.g., Safe Work Practices LIR), and definition of roles and responsibilities within LANL. • Final ISM milestone scheduled for January 1999.
<i>Jackhammer</i> JON 1	LANL management needs to formally embrace and support the Facility Management Unit concept to assure that all levels of the LANL organization are committed to the program’s purpose and policy, expedite its implementation, and prevent Division Director level decisions from circumventing the program’s objectives.	Closed	<p>Actions ongoing under ISM.</p> <ul style="list-style-type: none"> • Facility management “off ramp” requirements for ISM have been incorporated in the UC contract. • FMUs, including deployed ESH staff and dedicated crafts, have been implemented across LANL. • The “flagship” FMUs (e.g., Technical Area 55) have well-structured organizations, experienced and knowledgeable management teams, and the strong support of their Division Directors. However, this statement does not currently apply to all FMUs. • Facility/tenant agreements completed for all FMUs are a necessary, but not a sufficient, step for clarifying all aspects of roles and responsibilities. • Without full and successful implementation of LIRs on Safe Work Practices, and explicit definition/acceptance of responsibilities for various positions within the Lab, interaction between Facility Managers and Group Leaders continues to be difficult. The current process is not systematic and cannot ensure that Facility Managers’ safety concerns are consistently considered. • The Facility Management Program lacks authority and organizational prominence to be fully effective. • Final ISM milestone scheduled for January 1999.

<i>Jackhammer</i> JON 2	LANL management needs to reassess the structure of facility line management organizations to assure that definitive responsibility for all facility/building operations and safety is assigned to one individual or his/her designee.	Closed	<p>Actions ongoing under ISM.</p> <ul style="list-style-type: none"> • Reassessment of FMU structure during 1996, and identification of institutional gaps and incorporation of some of their milestones into the ISM program has strengthened Facility Management Unit's approach at LANL. • Facility/tenant agreements completed for all FMUs are a necessary, but not a sufficient, step for clarifying all aspects of roles and responsibilities. • Final ISM milestone scheduled for January 1999.
<i>Jackhammer</i> JON 3	LANL management needs to develop and standardize Laboratory programs that crosscut all the Facility Management Units, including but not limited to, maintenance, work planning, work control, configuration management, training, and quality assurance.	Closed	<p>Actions ongoing under ISM.</p> <ul style="list-style-type: none"> • LIRs for work planning and control, including hazard analysis issued by LANL. • Work planning and control implementing procedures not issued by many FMUs and work providers. • LIRs for work control and hazards analysis are not uniformly applied by FMUs, are not consistently applied to all facility work (e.g., utilities, outside contractors, construction, LANL services). • ISM milestones, along with performance measures, have been included in the UC contract. • Laboratory programs for maintenance, work planning and control, quality assurance, training are in place. • Efforts are under way to include the milestones of Configuration Management into ISM.
<i>Jackhammer</i> JON 4	LANL management needs to assure that lab projects that involve maintenance, construction, or modifications to facilities/buildings are structured so that all aspects of the project are under the control of facility line management, and that work planning and control for these projects follow standardized Lab-wide procedures and processes.	Closed	<p>Actions ongoing under ISM.</p> <ul style="list-style-type: none"> • Although LIRs and LIGs have been issued to standardize facility work control including maintenance and modifications, work planning and control implementing procedures at the FMU level are lacking. • An LIR, which standardizes construction work planning and control, is in development, but not issued. • LIRs and LIGs for R&D or programmatic work control have yet to be developed and/or effectively implemented at the FMUs. • Facility Safety Plans, which will define worker safety envelopes within the FMUs, have yet to be developed. • Final ISM milestone scheduled for January 1999.
<i>Jackhammer</i> JON 5	LANL management needs to ensure that Lab subcontractors are not requested or allowed to perform work outside the scope of their contract or beyond the capabilities and expertise of their personnel.	Closed	<p>JON not fully satisfied.</p> <ul style="list-style-type: none"> • Evidence that work scopes are still being exceeded by maintenance personnel. • Criteria and definition to determine whether work is being performed within the specified expertise is not clearly delineated. • LANL Facilities, Safeguards, and Security and ESH divisions issued master memos directing that all facility work, including subcontractor work, receive an ESH review prior to execution. JCNNM <i>Lessons Learned Bulletin</i> (June 1997) addresses performing unauthorized work. • A performance measure on Subcontractor Worker Protection was included in Appendix F of the UC/DOE contract. • Work control LIR specifies that work be done only as specified and that FMUs have a process to control field changes to work packages.
<i>Jackhammer</i> JON 7	The AL Manager needs to reassess the extent of the "teaming" approach as it is applied in the AL-LANL Pilot Oversight Program for ES&H to ensure the objectivity and effectiveness of line management's safety oversight.	Closed	<p>JON fully satisfied.</p> <ul style="list-style-type: none"> • JON corrective actions complete. • Relegation of ES&H responsibilities to LAAO and inclusion of ISM milestones into the UC contract have improved the interaction between LAAO and the Laboratory and have provided LAAO with appropriate management tools.

<i>Jackhammer</i> JON 28	LANL and JCNNM management need to develop and implement a process to ensure the acceptance and individual accountability for safety, through increased management presence in the field, improved worker understanding of safety requirements through training, and safety reinforcement through graded incentives and disciplinary actions.	Closed	<p>Actions ongoing under ISM.</p> <ul style="list-style-type: none"> • Significant progress is evident, but continued progress is required to satisfy the JON. • Both LANL and JCNNM have established “walkaround” programs. • Mechanisms that hold employees accountable for safety (including disciplinary actions and rewards) have been established throughout LANL. In 1996, LANL issued detailed criteria for a range of disciplinary actions for poor ES&H performance. Since 1996, disciplinary actions have been taken against managers and workers who violated the ES&H policies. • LANL is currently piloting three behavior-based safety programs and intends to select the appropriate approach for Laboratory-wide implementation. Behavior-based safety is a major ISM program. At JCNNM awareness of safety has been improved through training associated with the implementation of behavior-based programs. • Selection of behavior-based safety approach for LANL scheduled for June 1998.
<i>Jackhammer</i> JON 29	LANL management needs to change the culture within the Lab and JCNNM by training and encouraging their employees to raise safety issues in the workplace and to provide accountability and disciplinary actions to those supervisory employees who discriminate against such actions.	Closed	<p>Actions ongoing under ISM.</p> <ul style="list-style-type: none"> • LANL and JCNNM initiatives are being implemented, which are enhancing worker empowerment and accountability for safety. However, continued emphasis is required to satisfy the JON. • Both LANL and JCNNM have established “walkaround” programs. • At JCNNM, awareness of safety has been improved through training associated with the implementation of behavior-based programs. • Mechanisms that hold employees accountable for safety (including disciplinary actions and rewards) have been established throughout LANL. • In 1996, LANL issued detailed criteria for a range of disciplinary actions for poor ES&H performance. Since 1996, disciplinary actions have been taken against managers and workers who violated the ES&H policies. • LANL is currently piloting three behavior-based safety programs, and intends to select the appropriate approach for Laboratory-wide implementation. Behavior-based safety is a major ISM program. • Selection of behavior-based approach for LANL scheduled for June 1998.
<i>Microwave</i> JON 1	LANL needs to assure that strong and publicized consequences for poor safety performance are applied to all managers and workers.	Closed	<p>JON fully satisfied.</p> <ul style="list-style-type: none"> • Mechanisms that hold employees accountable for safety (including disciplinary actions and rewards) have been established throughout LANL. • In 1996, LANL issued detailed criteria for a range of disciplinary actions for poor ES&H performance. Proposed disciplinary actions are applicable to all levels of employees. • Since 1996, disciplinary actions have been taken against managers and workers who violated the ES&H policies. Disciplinary actions have been widely publicized, within the bounds of privacy laws.

<p><i>Microwave</i> JON 6</p>	<p>The Accelerator Operations and Technology (AOT) Division needs to establish, communicate, and implement safety roles and responsibilities.</p>	<p>Closed</p>	<p>Actions ongoing under ISM.</p> <ul style="list-style-type: none"> • The FM at LANSCE Division (previously known as AOT Division), is experienced, knowledgeable, and has the support of division management. • Facility/tenant agreements have been completed and are a positive step forward in clarifying roles and responsibilities. • Without full and successful implementation of LIRs on Safe Work Practices, and explicit definition/acceptance of responsibilities for various positions within LANL, interaction between Facility Managers and Group Leaders continues to be difficult. The current process is not systematic and cannot ensure that Facility Managers' safety concerns are consistently considered. • Final ISM milestones scheduled for January 1999.
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Table 2 — Judgments of Need: Work Planning and Control

JON	Judgment of Need	Site Status	Accident Investigation Followup Status and Evaluation
<i>Forklift</i> JON 3	Develop and implement a positive system to ensure that all forklifts are assigned for safety and maintenance responsibilities as identified in Administrative Requirement 13-1.	Closed	<p>JON corrective actions complete, but not effectively implemented.</p> <ul style="list-style-type: none"> • Specific corrective actions are completed. • Revision to the LANL forklift procedure reissued as an LIR. Although the JCNNM forklift procedure has not incorporated latest institutional forklift requirements, JCNNM is required to follow the LIR. • Comprehensive site-wide assessment of lift trucks was completed by LANL in March 1997. • Two sections of Forklift LIR (sections 4.5 and 4.7) are not being performed by those assigned responsibility in the LIR. • Facility- and job-specific hazards are not being adequately addressed by proficiency instructors during the qualification of forklift operators. • Performance of some preoperational inspections, annual inspections, access controls, and placarding was not in accordance with LANL policy and training on forklifts.
<i>Forklift</i> JON 4	Develop and implement a system to control access to forklifts.	Closed	<p>JON corrective actions complete, but not effectively implemented.</p> <ul style="list-style-type: none"> • Progress in forklift access controls is evident. However, based on field observations, access controls have not been fully effective. • The new LIR requires prevention of unauthorized usage of forklifts through administrative or physical controls. However, no guidance or examples of acceptable administrative controls are provided. The honor system is still used by some groups to ensure access control. • Although forklift access controls have been identified for each facility, a key was observed in the ignition of a forklift during this review. Operators were not present, nor could the owner/operator be identified from the weathered and illegible placard on the forklift. • Since only a few forklifts were evaluated, LANL should determine if the identified access control concerns were isolated or indicative of problems at the divisional or institutional level.
<i>Forklift</i> JON 5	Reassess, consistent with manufacturers' recommendations, the desirability of retrofitting forklifts with personal restraint systems that include seat belts.	Closed	<p>JON fully satisfied.</p> <ul style="list-style-type: none"> • ESH-5 has completed several significant activities in evaluating personal restraint systems. • A site-wide inventory of forklift restraint systems was performed by ESH-5, and based on manufacturers' recommendations, a path forward for retrofitting forklifts with seat belts has been identified and is being implemented.

<i>Forklift</i> JON 6	Post on all forklifts data such as ownership, the inspection records, maintenance stickers, and a list of authorized operators and phone numbers.	Closed	JON corrective actions complete, but not effectively implemented or maintained. <ul style="list-style-type: none"> Placards were prepared, issued to forklift owners, and verified by ESH-5 as complete. All forklifts sampled by the team were placarded, however, most of the placards were not legible nor complete, as a result of weathering. The required annual maintenance inspection had lapsed on one forklift, as indicated on the placard.
<i>Forklift</i> JON 7	Ensure that adequate hazard recognition reviews are performed to identify and preclude practices such as manually carrying 150-pound gas cylinders.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> Generic hazard recognition and abatement is discussed within the Forklift Fundamentals Safety Course. Proficiency instruction does not consistently instruct nor evaluate operators on site-specific hazards. Although facility-specific hazards and facility-specific rules are identified on the Proficiency Evaluation Criteria Checklist, they are occasionally marked as "NA" by some instructors. Some operators are examined by proficiency instructors who are not familiar with the operator's work activities or hazards. LANL should determine if the lack of site-specific forklift hazard evaluations being performed by proficiency instructors is an isolated event, or indicative of a problem at the divisional or institutional level.
<i>Jackhammer</i> JON 6	LANL management needs to develop a process/procedure to confirm that Laboratory-wide actions, such as stop-work orders, are communicated, received, and verified to be in place.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> Stop-work procedure does not require appropriate notifications to facility managers, safety organization (ESH-5), or management for all stop-work actions, nor require documentation of all stop-work actions. Stop-work procedure inconsistent with Facility-Tenant Agreements LIR. Business Division procedure (memorandum) inadequate to ensure that Lab-wide actions are verified and remain in place. JCNNM stop-work procedure outdated and inconsistent with LANL procedure.
<i>Jackhammer</i> JON 8	LANL management needs to assure that the Standing Work Order (SWO) system is used only on routine, repetitive, and non-complex tasks where no significant risks or hazards have been identified or could reasonably be encountered.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> Skill of craft and graded hazard assessment formalized in LIRs and integrated into the work control processes. The Standing Work Order is presently used as an accounting mechanism, not as a blanket work instruction, and is less prone to abuse. The Standing Hazard Screens and Standing Activity Hazards Analysis (SAHA), which are used for many maintenance activities of a repetitive nature, are inconsistently applied across FMUs. The current use of Standing Hazard Screens and SAHAs permits conditions similar to those under the previous SWO program, and impedes an effective application of skill of the craft.
<i>Jackhammer</i> JON 9	Based on other DOE site experience, the AL Manager and the LAAO Area Manager need to re-evaluate the continued use of SWOs at LANL.	Open	JON open, not evaluated. <ul style="list-style-type: none"> LAAO assessment of SWOs not complete. AL verification of completion in progress, according to AIMS.

<i>Jackhammer</i> JON 10	LANL and JCNNM management need to develop and standardize Laboratory-wide work planning and control procedures, and processes for construction and maintenance activities.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> • LIRs and LIGs establish roles and responsibilities for work control, and provide guidance on preparing work packages. • Laboratory LIR/LIG for construction work not yet issued. • Requirements for ES&H field inspections not clearly specified in work control/hazard analysis LIRs/LIGs. • FMUs still use different methods for requesting and authorizing work. Still a variety of work request/control forms and processes in use. • Numerous failures to follow procedures, and errors and omissions observed in completed work packages.
<i>Jackhammer</i> JON 11	LANL management needs to ensure that the Laboratory develops, as part of the Laboratory-wide control procedures, a well-defined, risk-based (graded) methodology for assignment of “management levels” for work packages based on the hazards to which craft persons are expected to be exposed.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> • New LIR and LIG define and guide determination of Management Levels, and Management Levels are being specified on work requests. • Detailed instructions and guidance provided in institutional procedures. • Interviews indicated not all responsible FMU personnel fully understand the application of this grading process. • Use of management levels not an effective gradation for FMUs, which do not include nuclear facilities. At these FMUs, process results in all work being designated at the lowest management levels.
<i>Jackhammer</i> JON 22	JCNNM management needs to provide aggressive and structured monitoring, oversight, followup, and feedback to ensure effective integration of safety procedures and requirements into training courses and materials, which are then implemented in accordance with JCNNM training procedures.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> • JCNNM has procedures for incorporating assessments and lessons learned information into training programs. • Specified corrective action to develop training to revised JCNNM ES&H manual not completed because ES&H manual has not been revised, but JON was closed without addressing or revising this committed action. • JCNNM training database rolled into LANL database. • JCNNM procedure issued requiring a review and incorporation of new/revised ES&H requirements into JCNNM procedures. However, procedures identified for incorporation of ES&H requirements are also scheduled for cancellation.
<i>Jackhammer</i> JON 24	LANL management needs to implement effective work planning and control procedures and training in the assessment of hazards, identification and use of personal protective equipment required.	Open	JON open, not evaluated. <ul style="list-style-type: none"> • The corrective action for JON behind schedule. • Neither institutional procedures nor implementing procedures of FMU or JCNNM consistently nor adequately define the qualification and training requirements for doing hazards analysis or specify the criteria for designating “qualified” and “authorized” personnel. • Grading and criteria for FMU work control review and hazard controls defined in institutional procedures.
<i>Microwave</i> JON 8	Accelerator Operations and Technology-9 needs to determine why procedures were not followed and implement necessary controls to prevent a recurrence.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> • The LIR for “Safe Work Practices” (SWPs), which describes a work control process for programmatic/R&D work, was issued in January 1998. • The corrective actions for this JON do not address the procedural non-compliance issues or extent of condition of procedural non-compliance across all LANSCE divisions. • At the LANSCE facility, Standard Operating Procedures (SOPs) and SWPs are not being initiated nor written in accordance with the requirements of Administrative Requirement 1-3. Although well written, SWPs are being incorrectly used in lieu of SOPs. • SWPs have been issued for periods of up to five months, although Administrative Requirement 1-3 limits SWPs to short-duration (less than 90-day) tasks.

Table 3 — Judgments of Need: Electrical Safety

JON	Judgment of Need	Site Status	Accident Investigation Followup Status and Evaluation
<i>Jackhammer</i> JON 12	LANL and JCNNM management need to revise laboratory procedures to emphasize the requirement for permits for penetrations or excavation outside facilities/buildings whenever groundbreaking or cutting into walls or floors is to be performed.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> JCNNM procedures adequately revised and incorporate required reviews. Institutional excavation/penetration procedures not developed/ revised. Electrical LIR requirements do not address permits, authorizations, documentation, and implementation methods. Lacking institutional procedures, some divisions have developed divisional excavation/penetration procedures. LANL direct subcontractors lack procedures (similar to JCNNM procedures) to control penetration/excavation.
<i>Jackhammer</i> JON 13	LANL management needs to assess the critical power requirements for building TA-21-209 and other nuclear facilities to ensure that temporary emergency power requirements are known in the event of loss of external power. Temporary emergency power plans and procedures should be prepared.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> JCNNM revised Backup Generator Systems Maintenance, Testing, and Repair procedure and added a section on temporary generator hookup requirements. The procedure does not address generator or cable storage locations or details regarding connection of power to specific buildings. Temporary emergency power plans are being prepared but are only about 40% complete.
<i>Jackhammer</i> JON 14	JCNNM management needs to ensure that appropriate personal protective equipment is available and utilized by all craft workers when hazards have been identified in the work they are to perform.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> Training conducted on Personal Protective Equipment (PPE) requirements and use. Institutional and JCNNM Hazards Analysis and Control procedures address specification of PPE. New JCNNM work control process procedure does not specifically address PPE in any manner; as part of worker or supervisory responsibilities, as part of Activity Hazards Analysis, or as part of the pre-job briefing.
<i>Jackhammer</i> JON 15	JCNNM management needs to ensure that all PPE is tested in accordance with national consensus standards and federal regulations; tracked by date and personnel assignment; and retested.	Closed	JON fully satisfied. <ul style="list-style-type: none"> Database established for issue, recall, testing, and retesting of PPE. Personnel trained in the inspection and use of PPE. Issue and return locations consolidated for better control.
<i>Jackhammer</i> JON 16	LANL management needs to develop and complete implementation of a formal electrical safety program for the laboratory in a timely fashion utilizing the assistance and material developed by the department's electrical safety committee.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> AL/LAAO/LANL closure based on submittal of LANL electrical safety program implementation plan. Sound program developed (Electrical Safety LIR and LIG). Electrical Safety Committee actively pursuing significant issues. Electrical Safety Officers reviewing and monitoring electrical work. Implementation inconsistent and has not started for some divisions. Failure to follow procedures (lockouts/tagouts, Standard Electrical Work Procedures) hindering implementation.

<i>Microwave</i> JON 3	Consistent with the conditions of the pilot oversight program, AL and LANL need to conduct a for-cause review of electrical safety programs at LANL.	Closed	<p>JON fully satisfied.</p> <ul style="list-style-type: none"> • To fulfill the requirement of a for-cause review, AL, LAAO, and LANL established a joint task force to review electrical issues at LANL and develop an electrical safety program that would address those issues. • The electrical safety program was developed and is being implemented. • The functions of the task force to review electrical issues have continued through the Electrical Safety Committee and Division and Group Electrical Safety Officers. • Implementation of the electrical safety program has been added to the integrated safety management program implementation plan to improve visibility and tracking.
<i>Microwave</i> JON 7	The Accelerator Operations and Technology Division needs to correct deficiencies in the Accelerator Operations and Technology-9 group electrical safety training program and needs to review the status of training in other groups within the division.	Closed	<p>JON not fully satisfied.</p> <ul style="list-style-type: none"> • Assignment of on-the-job training (OJT) categories for LANSCE 8, LANSCE 9 electrical procedures is not conservative nor consistent with other LANSCE groups and needs to be re-evaluated. • Electrical safety training/retraining completed for all LANSCE groups. • Marked improvement in training compliance division-wide. • Formal OJT program developed and being implemented.

Table 4 — Judgments of Need: Self-Assessments and Lessons Learned

JON	Judgment of Need	Site Status	Accident Investigation Followup Status and Evaluation
<i>Jackhammer</i> JON 17	LANL management needs to continue to perform internal assessments to improve the Laboratory's level of compliance with Director's policies, to bring cases of non-compliance immediately to the Director's attention, and to assure the timely completion of corrective actions.	Closed	<p>JON fully satisfied.</p> <ul style="list-style-type: none"> • LANL self-assessments are addressed by the ISM plan to include Division Directors (quarterly), Safety Function Managers (semi-annually), and management walkarounds. • The AA-2 independent assessments of accident-related issues resulted in the identification of appropriate findings, conclusions, and recommendations. • AA-2 assessments of work control and forklifts conducted in 1997 were thorough and comprehensive; however, some corrective actions were not fully effective. • AA-1 is responsible for assisting managers in developing, tracking, and completing corrective actions. However, findings from the internal assessments are not being entered into the database for historical records if no corrective actions were pending. • A new and improved integrated data management and analysis system (called the I-TRACK system) has been developed as part of LANL's ISM plan.
<i>Jackhammer</i> JON 18	LANL management needs to analyze data from occurrence reports on a monthly basis, assure implementation of corrective actions, and identify to the Director, LANL, adverse worker and programmatic safety trends to enable management to be proactive in requesting detailed investigations and/or stopping work prior to personnel injuries or fatalities.	Closed	<p>JON not fully satisfied.</p> <ul style="list-style-type: none"> • Occurrence data is communicated to line management, however, ensuring implementation of corrective actions is not proceduralized. Also see Microwave JONs 2A and 2B. • No mechanism is in place to ensure that occurrences being communicated to line management are reviewed, evaluated, and acted upon to prevent recurrence. • Daily occurrence status reports, biweekly lessons learned reports, and quarterly Appendix F occurrence summaries are prepared by ESH-7. • The video on the Chemistry and Metallurgy Research (CMR) explosion incorporated lessons learned from other Type A accident investigations at LANL. The video, which was used during a LANL management workshop, was also featured at "Safety Days 1997." • Plans to incorporate lessons learned into the ISM home page are still in progress.
<i>Jackhammer</i> JON 19	The LAAO Area Manager needs to review the assignments and activities of the Facility Representatives (FRs) to ensure that objective and effective line management safety oversight is being performed through the day-to-day monitoring of LANL activities.	Open	<p>JON open, not evaluated.</p> <ul style="list-style-type: none"> • Closure of JON is dependent upon the adequacy of the next FR quarterly reports (January 1998). • First quarterly reports using the new reformatted report were scheduled for completion in January 1998. • FR activities have been reviewed and reassignments were made to optimize FR resources. The Safety and Health Team Leader position has been established and permanently filled. • Roles and responsibilities for the FRs have been clarified through new standing instructions.

<i>Jackhammer</i> JON 21	AL, LAAO, and the Los Alamos EH Residents Office need to track all corrective actions proposed in response to this Type A Accident Investigation to closure.	Open	JON open, not evaluated. <ul style="list-style-type: none"> This JON is open pending the completion of all corrective actions associated with the jackhammer event. Corrective actions are described, recorded, and tracked in the AL Assessment Information Management System (AIMS) database for the three Type A accidents. However, AIMS is not being used for all AL internal/external assessments as previously planned by AL. Corrective action closures require objective evidence by LANL, verification by AA-1, a "completion certificate," and concurrence by AL/LAAO. AL is responsible for keeping accident investigation-related records for DOE action items. Evidence files and the AIMS reports lack detail and rationale for completion or closure of DOE-assigned JONs. Assignment of responsibility for Jackhammer JON 26, involving training of emergency medical technicians at the Los Alamos Fire Department by AL/LAAO, has not been timely.
<i>Jackhammer</i> JON 23	LANL management needs to evaluate the effectiveness of the implementation of the JCNNM training program by observing and measuring workplace performance.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> Effectiveness of LANL and JCNNM training has not been measured and no formal process is in place for evaluating the effectiveness of training. The LANL self-assessment for institutional ES&H training, while evaluating the effectiveness of Radiological Control Technician training, did not evaluate the effectiveness of training provided in electrical safety, work control, forklift operations, fitness for duty, or on-the-job training. Self-assessment of JCNNM training and an independent review was completed in 1997. The review identified that a systematic evaluation of the effectiveness of training is not established. Changes noted in JCNNM training programs have resulted in greater safety awareness by the crafts, training that is tailored to the craft work, and involvement of the crafts in training development.
<i>Jackhammer</i> JON 25	The LAAO Area Manager needs to assure that LAAO personnel are trained in appropriate DOE accident investigation methods and procedures.	Closed	JON fully satisfied. <ul style="list-style-type: none"> Accident investigation training was conducted in April 1997 for all AL area offices by AL using training materials consistent with DOE accident investigation program guidance. Additional accident investigation training was provided in December 1997, and personnel are scheduled for training in January 1998.
<i>Jackhammer</i> JON 26	LANL management needs to consider funding for training and certification of Los Alamos Fire Department emergency medical technicians in the administration of cardiac medication, or to contract for emergency medical technicians already trained and certified for this skill.	Open	JON open, not evaluated. <ul style="list-style-type: none"> JON well behind original schedule. AL/LAAO has not taken timely action to ensure this JON has been resolved. Responsibility for this JON, originally assigned to LANL, was transferred to LAAO in July 1997.
<i>Jackhammer</i> JON 27	LANL management needs to consider funding or contracting for modifications to Protective Technologies, Los Alamos procedures, equipment, and staffing to enable that organization's 911 operators to stay on the line with callers whenever continuity of communication is needed.	Closed	JON fully satisfied. <ul style="list-style-type: none"> Documentation and study by U.S. West indicated system is adequate and concluded that no changes were required to the 911 system. The study by U.S. West was coordinated with local emergency organizations.

<i>Microwave</i> JON 2A	LANL needs to promptly implement corrective actions to address the lessons learned from this and other accidents.	Open	JON open, not evaluated. <ul style="list-style-type: none"> • The corrective action for JON behind schedule. • Neither JCNNM nor LANL have a program to ensure that needed corrective actions addressing lessons learned from accidents are identified and implemented. • Although Occurrence Reporting and Processing System data (including lessons-learned) is relayed by ESH-7, a formalized institutional lessons learned program has not been established by LANL. • A LANL news bulletin of lessons learned information was published. • JCNNM has established an effective lessons learned program. Lessons learned bulletins are routinely discussed with craft workers at biweekly safety meetings.
<i>Microwave</i> JON 2B	LANL needs to assure that lessons learned are applied across all elements of the Laboratory.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> • AA conducted an assessment of corrective actions based on JONs 5 through 8, and not JONs 1 through 4. Including JONs 1 through 4 should have identified lessons learned associated with fitness for duty and individual responsibility. • AA-1 did evaluate the effectiveness of corrective actions in addressing root causes. • AA's conclusion that there "were no effective practices identified" for communication to workers, and AL/LAAO's acceptance of this conclusion, indicates that a rigorous evaluation of the accident, LANL policies and procedures, or worker performance was not performed. • Significant lessons learned from the microwave accident were incorporated in the 1997 "CMR Explosion and What We've Learned" video.
<i>Microwave</i> JON 4	LANL needs to develop and implement a comprehensive Fitness for Duty (FFD) program for personnel involved in hazardous operations and their supervisors.	Closed	JON not fully satisfied. <ul style="list-style-type: none"> • There is no assurance that the FFD program has been communicated through General Employee Training (GET) or management training in a consistent and comprehensive manner down to all levels of the workforce. • GET is not provided on a recurring or refresher basis. • A master management memo dated July 9, 1997, required all supervisors and managers to complete a Fitness for Duty Awareness Self-Study Program by July 31, 1997. • LANL Training Integration Office provides oversight of JCNNM training. • LANL HR-6, which is responsible for FFD training, does a limited evaluation of training effectiveness. • JCNNM does not have a specific FFD training program, but relies on the LANL program.
<i>Microwave</i> JON 5	Accelerator Operations and Technology management needs to develop a system to routinely monitor the implementation of safety and other programs in accordance with LANL requirements.	Closed	JON fully satisfied. <ul style="list-style-type: none"> • Review of evidence files indicated closure is acceptable. • Interview with the LANSCE Facility Representative indicated the FR was actively involved in reviews of the microwave accident corrective actions. • Management walkarounds, training records were reviewed by the FR and the FR was involved in the validation of the corrective actions.

Appendix B

LANL Accident Investigation Followup Team Roster and Assignments

Office of Oversight Management Team

Deputy Assistant Secretary for Oversight

Glenn Podonsky

Associate Deputy Assistant Secretary

Neal Goldenberg

Director, Office of ES&H Evaluations

S. David Stadler
Michael Kilpatrick, Deputy Director

Director, Office of Security Evaluations

Barbara R. Stone

Director, Office of Planning and Analysis

Rebecca Smith
Frank Russo, Deputy Director

Director, Office of EH Residents

Ray Hardwick
Fred Volpe, Deputy Director

LANL Accident Investigation Followup Team

Team Leader

Robert Freeman

Team Members

Ali Ghovanlou, Management Systems and Worker Empowerment
Robert Compton, Work Planning and Control
James Lockridge, Work Planning and Control
Mark Good, Electrical Safety
Steve Kirchhoff, Corrective Actions, Assessments, Lessons Learned, and Training
Len Lojek, Corrective Actions, Assessments, Lessons Learned, and Training
Krista Peterson, Technical Coordinator for the Accident Investigation Followup Team